Scientific Programming With Python

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Scientific Programming With Python

What is scientific programming?

- Numeric heavy
- Visualisation

Numpy

```
import numpy as np
```

This is the recommended way to import numpy.

Numpy

Numpy provides ndarray:

- Multidimensional array
- Homogeneous arrays
- Reference semantics
- Arrays, not matrices

Example

```
ones = np.ones(3, dtype=np.float32)
onesc = ones
print ones
ones += 2
print ones
print onesc
```

Example

```
ones = np.ones(3, dtype=np.float32)
onesc = ones
print ones
ones += 2
print ones
print onesc
```

```
[ 1.  1.  1.]
[ 3.  3.  3.]
[ 3.  3.  3.]
```

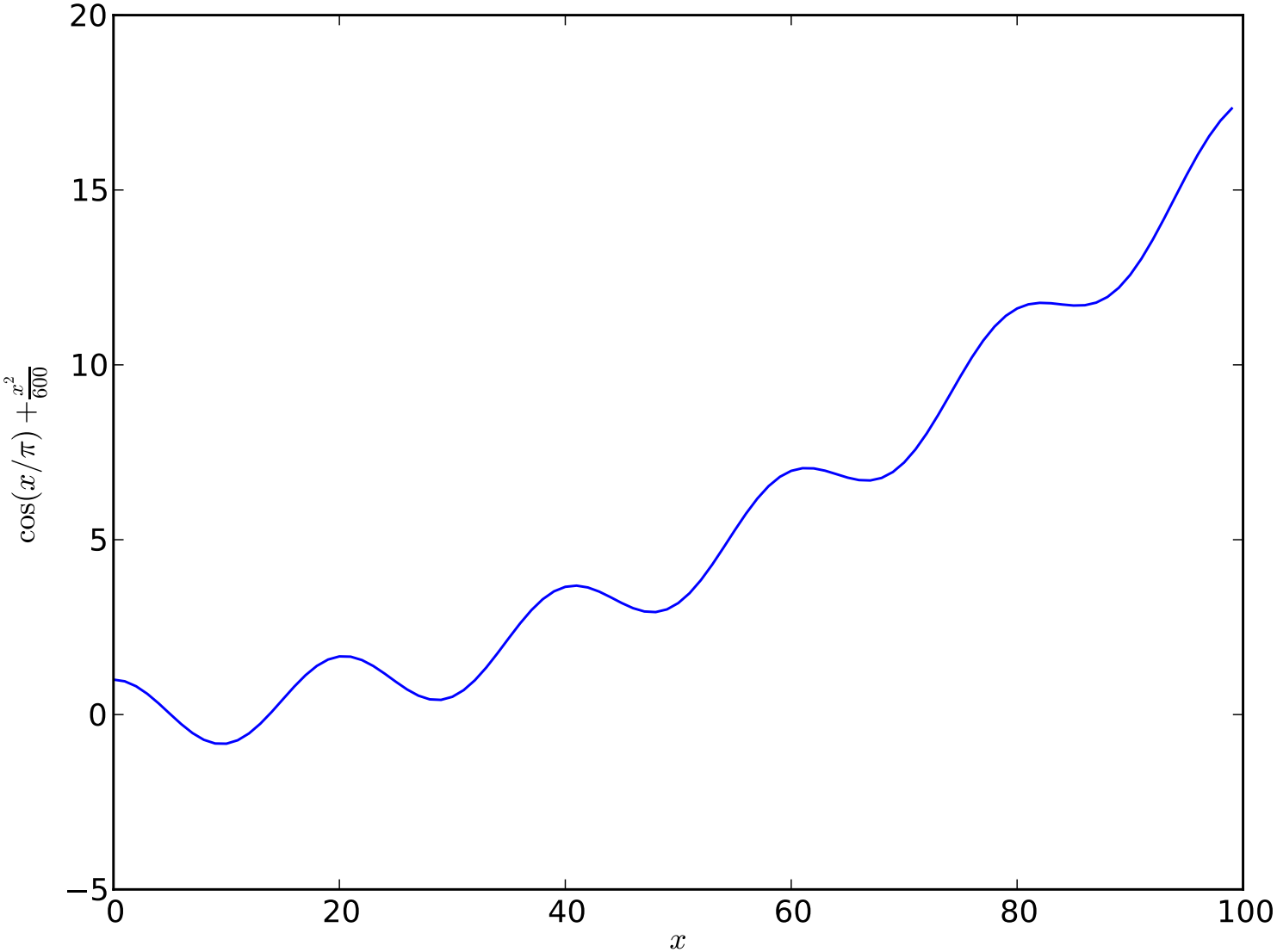
ones is a 1-dimensional array of 32 bit floats.

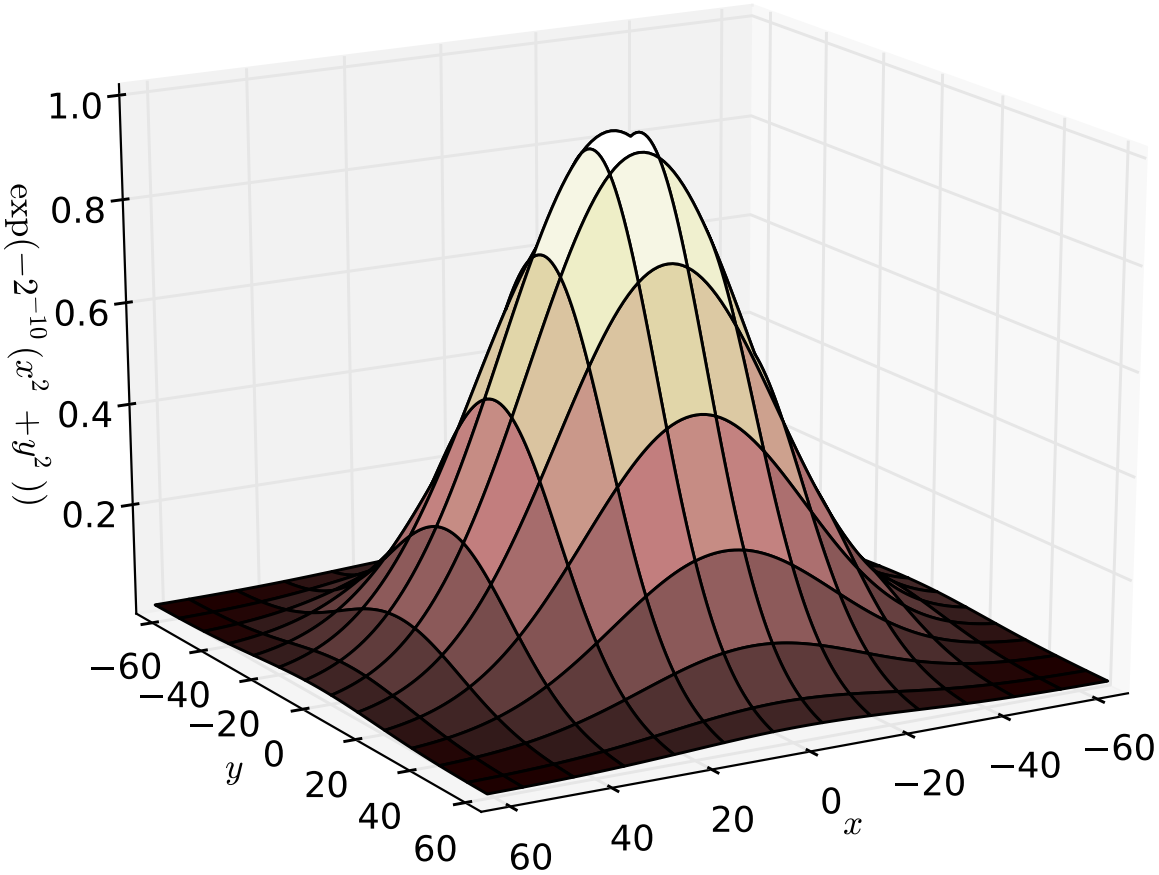
New Example

```
import numpy as np
import matplotlib.pylab as plt

X = np.arange(100)
Y = np.cos(X/np.pi)+X**2/600.

plt.plot(X, Y)
plt.xlabel(r'$x$')
plt.ylabel(r'$\cos x/\pi + \frac{x^2}{600}$')
plt.show()
```


20
15
10
5
0
−5
0
20
40
60
80
100
x
$\cos(x/\pi) + \frac{x^2}{600}$


1.0
0.8
0.6
0.4
0.2
$\exp(-2^{-10}(x^2+y^2))$
−60
−40
−20
0
20
40
60
y
60
40
20
0
−20
−40
−60
x

Broadcasting

```
iris = np.array([
    [5.1, 3.5, 1.4, 0.2],
    [4.9, 3.0, 1.4, 0.2],
    \dots])
means = iris.mean(axis=0)
print means
print (iris - means)
```

Broadcasting

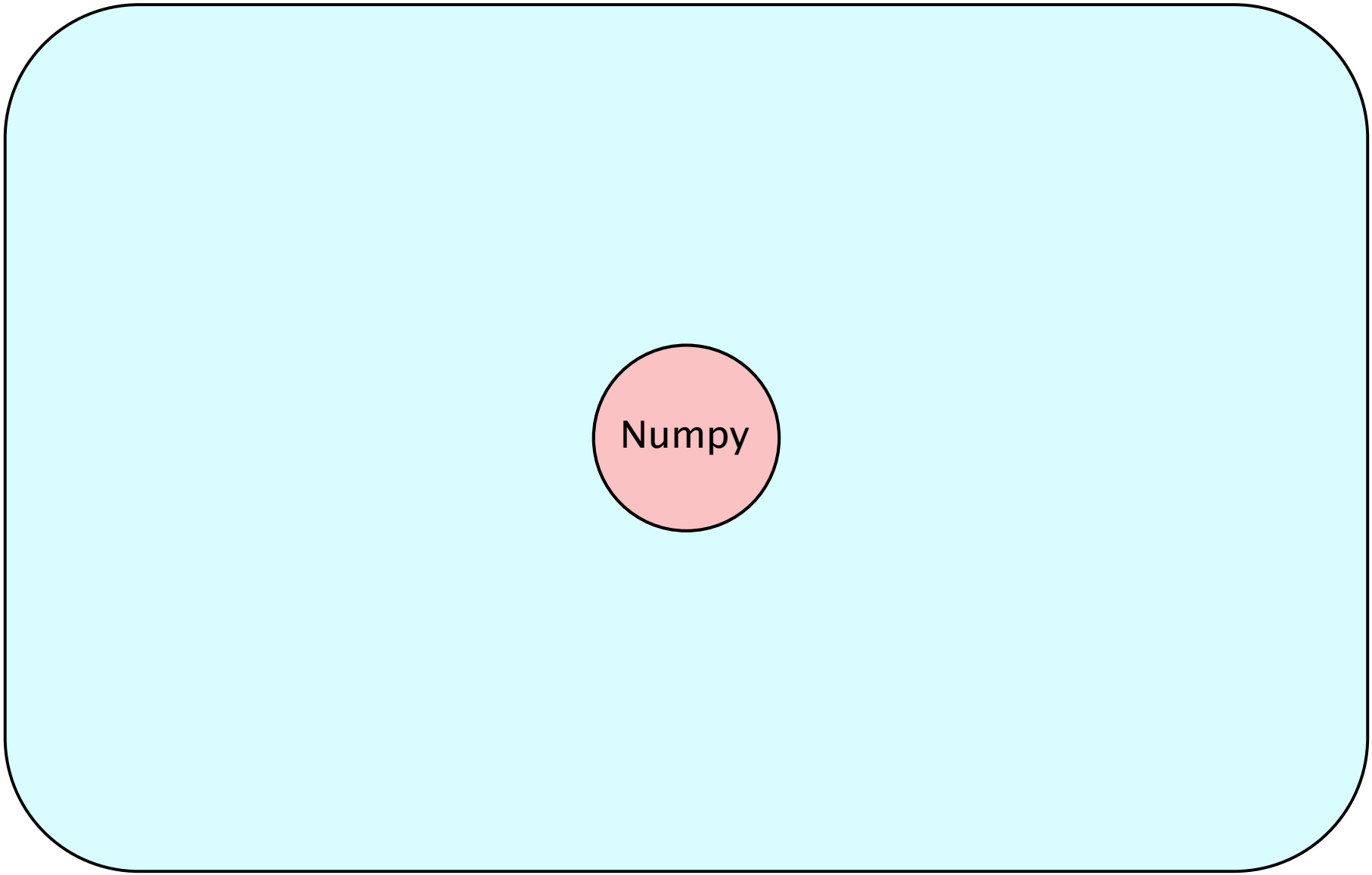
```
iris = np.array([
    [5.1, 3.5, 1.4, 0.2],
    [4.9, 3.0, 1.4, 0.2],
    \dots])
means = iris.mean(axis=0)
print means
print (iris - means)
```

```
[ 5.     3.25   1.4    0.2 ]
```

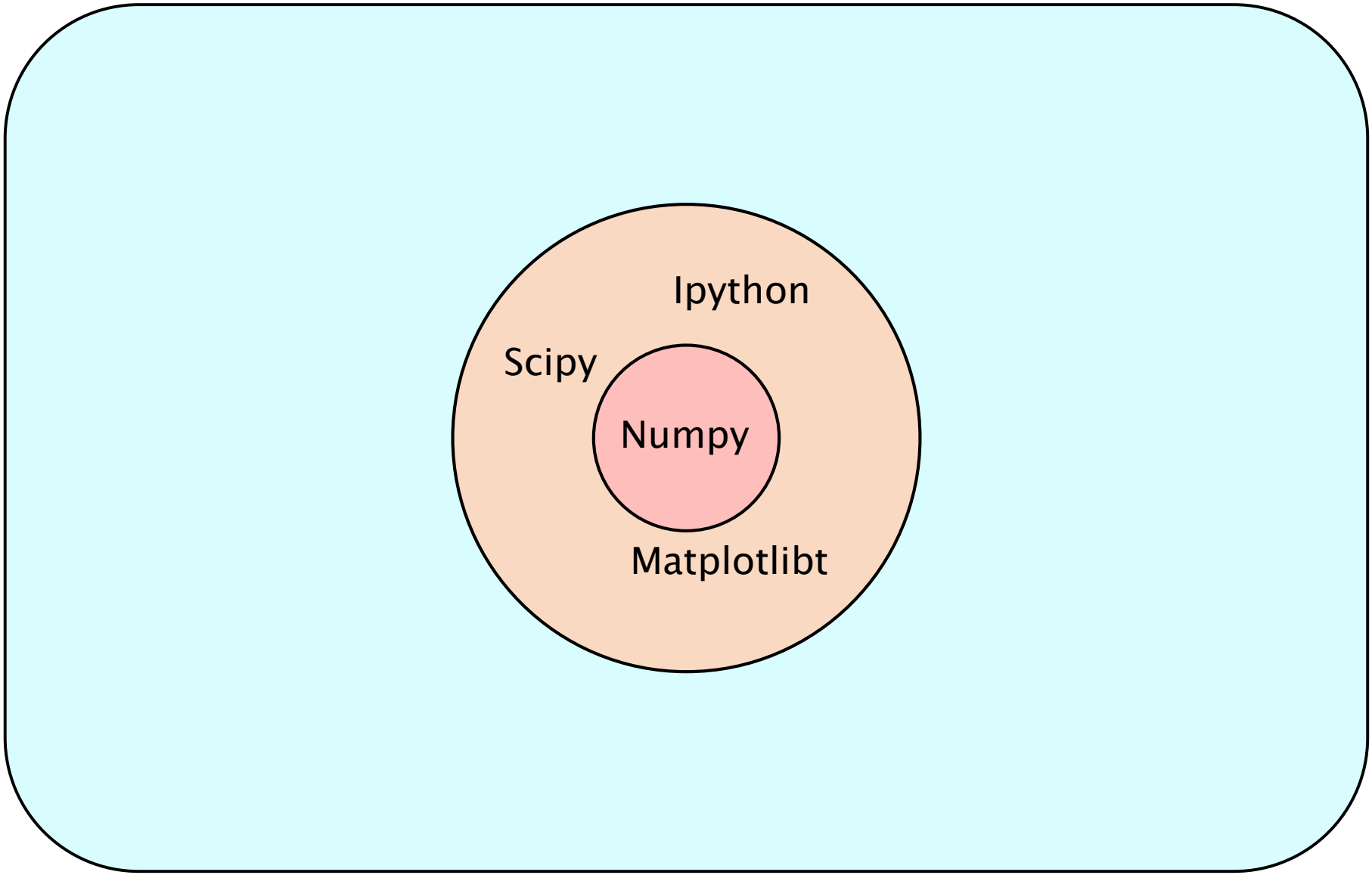
```
[[ 0.1    0.25   0.     0.  ]
 [-0.1   -0.25   0.     0.  ]]
```

means[0] is the mean of column 0
iris - means subtracts mean per row.

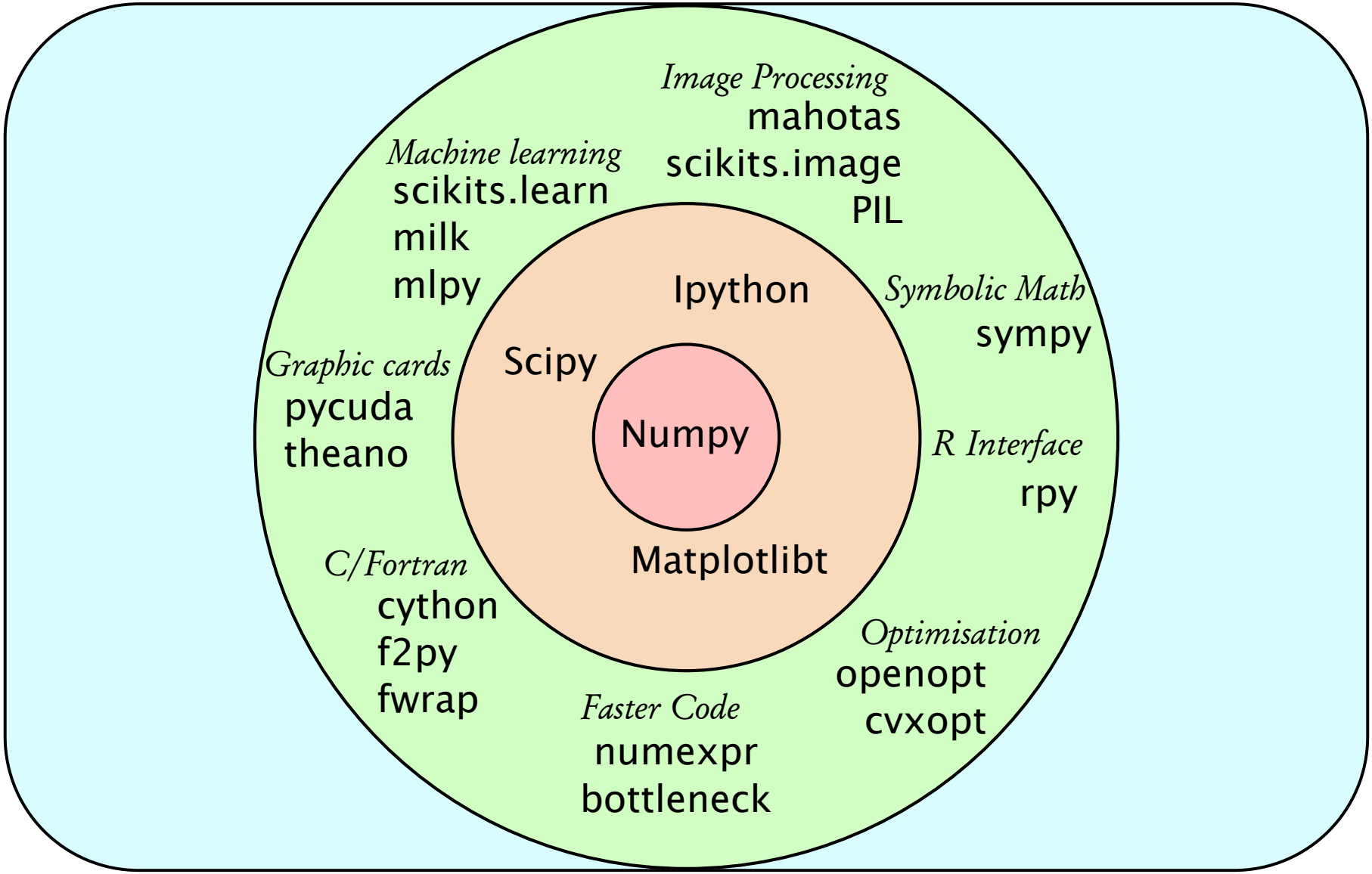
Python Scientific Ecosystem



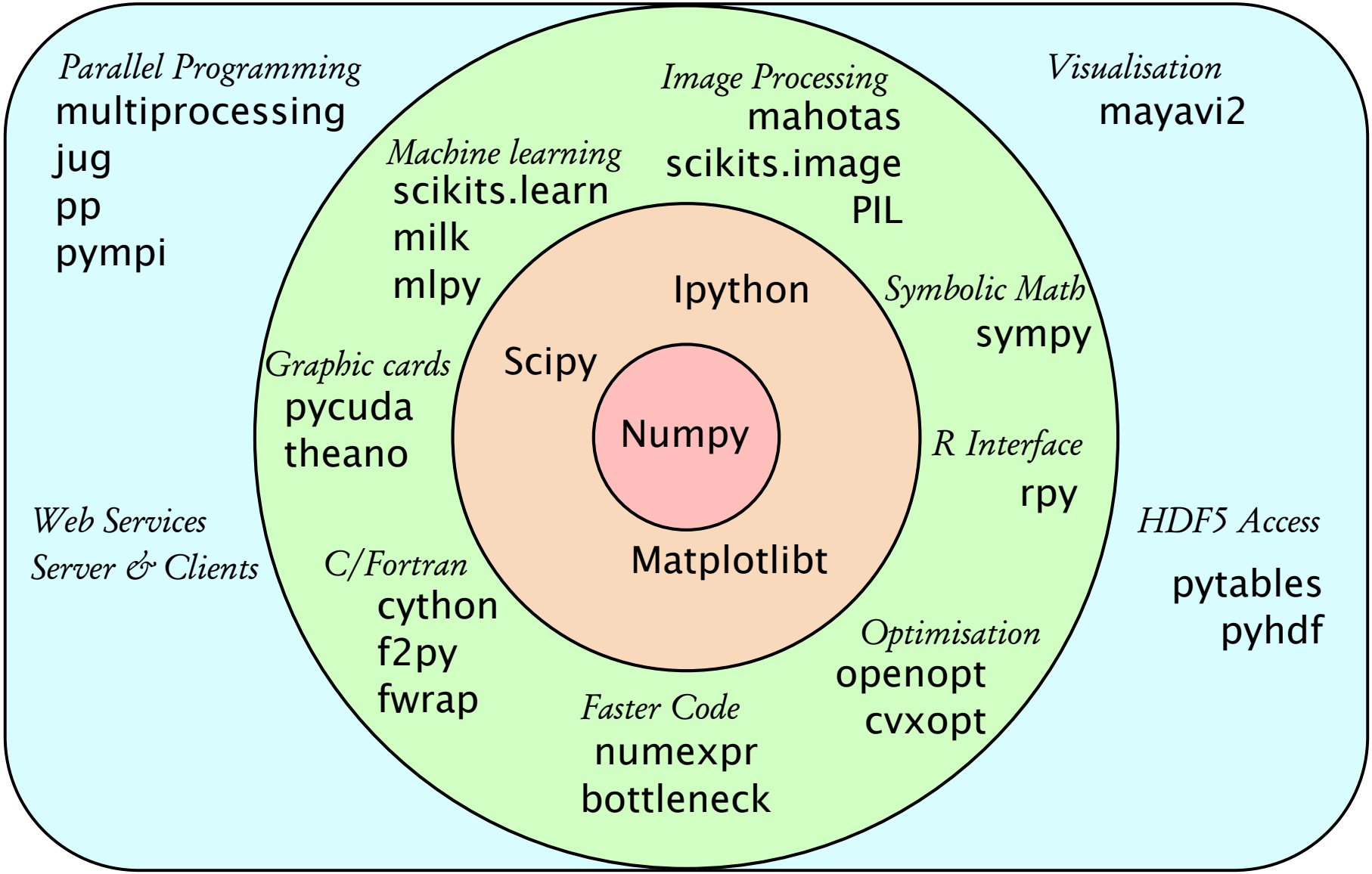
Python Scientific Ecosystem



Python Scientific Ecosystem



Python Scientific Ecosystem



Links

These slides are available at
http://luispedro.org/talks/2011

- Numpy: http://www.numpy.org
- Scipy: http://www.scipy.org
- Matplotlib: http://matplotlib.sf.net